BEST PRACTICE RECOMMENDATIONS FOR THE CARE OF NEWBORNS WITH NEONATAL ABSTINENCE SYNDROME

By

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Abstract

This thesis will explore the research on interventions used to manage neonatal abstinence syndrome (NAS). NAS is a drug withdrawal syndrome that affects a baby after birth who was exposed to drugs, typically opiates, in utero. Symptoms include extreme irritability and inconsolability caused by hyperactivity of the central nervous system and gastrointestinal system. The literature examined explores the employment of non-pharmacological interventions such as breastfeeding, swaddling, kangaroo care, rooming- in, and the eat-sleep-console method, as first priority interventions. As these interventions are becoming more and more prevalent in practice, it is necessary to understand which interventions are efficient at reducing length of treatment of pharmacologic management and length and cost of stay. In addition, it is necessary to evaluate the same outcomes with regards to pharmacologic interventions in order to identify the best practice in the case that medications become ethically necessary. Beyond the review of current literature, this paper will identify best-practice recommendations, a proposed implementation plan, and a proposed evaluation of the implementation process.

CHAPTER 1

Introduction

Statement of Purpose

The purpose of this thesis is to develop best practice recommendations to better provide care for babies with neonatal abstinence syndrome (NAS) in neonatal intensive care units (NICU). In this thesis, recommendations for best practice will be created using evidence-based research that discusses various treatment methods for NAS and their effects on neonatal outcomes. The background of the issue along with the relevance of the topic to nursing practice will be provided, followed by an evaluation of the evidence-based research as it pertains to NAS treatments. Lastly, a proposed best practice recommendation will be outlined with the objective of improving outcomes of babies that suffer from NAS after birth.

Background of Issue

Neonatal abstinence syndrome is a drug withdrawal syndrome that affects a baby after birth who was exposed to drugs, typically opiates, in utero. Prescription medications, including oxycodone, dilaudid, methadone, buprenorphine, fentanyl, and illicit drugs, like heroin, can cause NAS. NAS includes a range of physiologic and neurobehavioral signs and symptoms such as, hyper-irritability, tremors, hyperreflexia, high-pitched crying, difficulty being consoled, poor feeding, diarrhea, vomiting, weight loss, sleep problems, apnea, yawning, sneezing, sweating, runny nose, and watery eyes (Durham & Chapman, 2014, p. 469). Short and long-term effects of NAS include prematurity, hypoxia, intrauterine growth restriction, low birth weight, microcephaly, increased risk for meconium fluid aspiration, congenital infections, increased risk for sudden infant death syndrome, and an increased risk for chromosomal abnormalities (Durham & Chapman, 2014, p. 471).

According to MacMullen and Samson (2018), NAS is diagnosed based off maternal history of drug use and neonatal assessment of signs and symptoms of withdrawal. The Finnegan Neonatal Abstinence Scoring Tool is a five-point scale used to rate the intensity of the signs and symptoms with a maximum score of 44; the higher the score, the greater the severity of the symptoms (MacMullen & Samson, 2018). Clinical management is therefore based upon the severity of the symptoms. Typically, non-pharmacologic treatments are initiated first, such as swaddling, cluster care, limited exposure to light and sound, music therapy, cuddling, maternal-infant bonding via breastfeeding, and rooming-in. When needed, pharmacologic interventions are used, with morphine being the primary medication administered, followed by methadone, buprenorphine, phenobarbital, and clonidine. While it may seem counterintuitive to treat the newborn with the same class of drug that contributed to the cause of NAS, it is the standard intervention for subduing the withdrawal symptoms. Yet, it seems as if more and more healthcare professionals are stressing the employment of alternative therapies prior to administering any medications, which is backed by current research.

Significance of the Problem

The incidence of NAS has increased over the past decade in conjunction with the opioid epidemic in the United States. According to the 2017 National Survey of Drug Use and Health organized by the US Department of Health and Human Services (HHS), 11.4 million people misused prescription opioids and 2.1 million people had an opioid use disorder in 2016 and 2017 alone. In addition, there was a five-fold increase in the number of babies born with NAS from 2000-2012, estimating to be 21,732 babies, which is equivalent to one baby born with NAS every 25 minutes (HHS, 2018). Babies who have been exposed to illicit drugs in utero are

admitted to the NICU in order to be monitored for signs and symptoms of withdrawal and treated as necessary.

The length of stay in the NICU is dependent on the type of substance the baby was exposed to since each kind of drug elicits different responses and withdrawal periods. Because the length of stay in the hospital is prolonged for those babies with NAS, the cost incurred is significant and that trend can continue into infancy and childhood due to the effects that drugs can have on growth, behavior, and cognition.

In addition, there is a likelihood that the biological mother of the child will not be able to assume their role as a mother due to the harm inflicted on the baby as a result of prenatal drug exposure. Fetal development is an extremely critical period for growth and development in a child's life and opiate exposure in utero can have a negative effect on fetal growth and neurological development. As a result, The Department of Child Services (DCS) becomes involved in the case after the baby is born to evaluate whether or not the baby will be cared for effectively and in a safe environment in order to determine if the parents resume custody of the child. There is a DCS program called SENSE, or Substance Exposed Newborn Safe Environment, which consists of many home-visits and parent education, and it has the ultimate goal of keeping the families together, which is ideal for improved outcomes of the baby. However, if deemed unsafe, the baby will be placed into custody of a foster care family who will care for the child. This happens in about 25% of the cases, however, 69% of the time the infants are discharged to their mother, so there is hope that the family unit can be preserved (Fragassi & Bora, 2018).

Overall, the effects that substance exposure in utero has is extensive, not only for the newborn immediately after birth, but also long-term effects, the psychological effects on the

mother, the cost, and the overall disruption of a family dynamic. In response to the opioid epidemic in the country, healthcare providers should seek out the best practice for the treatment of NAS so as to preserve and encourage the baby's health and wellbeing after birth.

Summary

The purpose of this thesis is to develop best practice recommendations to better provide care to babies who suffer from NAS after birth. The intended purpose of this research review is to discover what has been effective in treating NAS, as well as identify treatments that can be improved upon; with this information, evidence-based recommendations can be created to establish a first-line treatment for NAS in the NICU that has the greatest benefits for the newborn.

CHAPTER 2

Review of Literature

Chapter two presents a literature review focused on caring for babies with neonatal abstinence syndrome. The research for this thesis was conducted through searches on PubMed and CINAHL databases for published articles between the years of 2012 and 2019 in peer-reviewed journals. Searches were run using the keywords "neonatal abstinence syndrome," "treatment", and "non-pharmacologic." Ten articles were selected to be used for this review based on a variety of interventions analyzed and recommendations made for management of NAS in the hospital. The results from these articles will be applied as evidenced based recommendations for best practice for the care of newborns with NAS.

Interventions for Management of Neonatal Abstinence Syndrome

Nonpharmacologic

NAS, while it is an acute problem that affects the newborn, stems from a mother's addiction to opioids. In that way, NAS should be treated as a "cascade of care" that encompasses primary prevention, prenatal care, delivery, and aftercare (Syvertsen, Toneff, Madden, & Clapp, 2018). The opioid epidemic more commonly affects those at a social disadvantage, such as those who live in poverty, have a lack of education, are exposed to drug abuse across generations, and have limited access to opportunities (Syvertsen et al., 2018). With that being said, efforts in community populations should be made to target the risk factors associated with opioid use in order to minimize the power of unfavorable social determinants of health. In addition, comprehensive prenatal care should be sought, including support groups and medicated assisted treatment (MAT) (Syvertsen et al., 2018). At the time of delivery, a supportive health care team is vital for sustaining nonjudgmental care in the event of an NAS diagnosis (Syvertsen et al.,

2018). Lastly, aftercare for the families, comprised of access to drug treatment, social services, monitoring of child development, and ensuring a healthy home environment, can facilitate the transition to a stable life at home for the infant (Syvertsen et al., 2018).

According to Sanlorenzo, Stark, and Patrick (2018), there is a decreased cost and length of hospital stay for infants with NAS that is associated with rooming-in by parents for treatment in the NICU. Parental presence at the bedside significantly reduced the duration of opioid therapy days and length of stay in the NICU by greater than five days (Sanlorenzo et al., 2018). This data suggests that rooming-in, which minimizes the separation of the maternal-infant relationship, can be a beneficial non-pharmacologic intervention for treatment of NAS.

More non-pharmacological interventions that have become more popular include: a low stimulation environment, continuous care provided by parents rooming in or staff if parents are unavailable, increased involvement of parents in care before resorting to pharmacologic treatments, and strictly breastfeeding provided there are no hospital policy restrictions (Grossman et al., 2017). The assessment of the infants in this study were based off of three categories: the infant's ability to eat by breastfeeding or taking an ounce or greater from a bottle, to sleep undisturbed for an hour or more, and to be consoled within ten minutes, which is otherwise known as the eat-sleep-console method (ESC) (Grossman et al., 2017). If these criteria were not met, nonpharmacologic interventions would be maximized before administering a 0.05 mg/kg dose of morphine to manage the withdrawal symptoms. After implementation of the eat, sleep, console protocol, there was a significant decrease in length of stay in the hospital from 22 days to five days; decrease in number of babies treated with morphine from 54 out of 55 babies (98%) to six out of 44 (14%); decrease in cost of stay from $44,824 to $10,289; decrease in NICU admissions from all 55 babies (100%) to nine infants out of the 44 (20%); and an increase

in the number of infants who were breastfed (Grossman et al., 2017). It is interesting to note that the NICU was deemed by Grossman et al. (2017) as an unsuitable environment for managing NAS because the units aren't often equipped for rooming in or sustaining non-pharmacologic interventions besides swaddling. This indicates that other inpatient units may be more efficient for managing NAS due to their low-stimulation environments and optimization of the mother-baby dyad and family-centered care (Grossman et al., 2017).

More recently, Grossman, Lipshaw, Osborn, and Berkwitt (2018) retrospectively reviewed charts of newborns managed with the ESC method that was described previously and results revealed that 12% of newborns received morphine using the ESC assessment tool whereas 62% would have received a dose if managed using the traditional Finnegan scoring tool. Additionally, length of stay would have been 10 days longer for those pharmacologically managed newborns due to the incremental process of weaning (Grossman et al., 2018).

Wachman et al. (2018) focused on a quality improvement project to improve neonatal outcomes for infants with NAS. A pre-intervention group was assessed using the Finnegan scoring tool and were started on pharmacologic treatment when the neonates scored an eight or more twice or twelve or more once (Wachman et al., 2018). On the other hand, the intervention group was assessed using the function-based ESC model (Wachman et al., 2018). Findings showed that after the implementation of the ESC initiative, there was a decrease in the length of stay from 17 days to 11 days, decrease in pharmacologic treatment from 87.1% to 40%, and lastly, a decrease in adjunctive medication administration alongside pharmacologic treatments from 33.6% to 2.4% (Wachman et al., 2018). One limitation of the ESC implementation is that babies were handpicked in many of the studies to receive the intervention which is an example of selection bias and reduces the reliability and validity of the study.

Boucher (2017) conducted a systematic review regarding rooming-in and neonatal outcomes as a result. In one study, she found that 79.2% of babies who had been exposed to opioids in utero were less likely to receive opioid treatment if they were able to room in with their mothers in comparison to 88.9% of the babies requiring opioid treatment who were cohabitating with their mothers (Boucher, 2017). In addition, those neonates who roomed-in had a shorter duration of pharmacologic management of NAS by five days and a shorter average length of stay in the hospital by seven days in comparison to those babies who did not room-in (Boucher, 2017). Another study the author reviewed had similar results. This particular study implemented an initiative for NAS management where infants who did not require pharmacologic management of symptoms remained in the postnatal ward (Boucher, 2017). If a neonate who scored three consecutive scores of eight or higher on the Finnegan Scale, pharmacologic treatment was indicated and that infant would be transferred to the NICU for care only until a maintenance dose was established as indicated by three stable Finnegan scores less than eight; at this point, the infant would return to the postnatal ward (Boucher, 2017). The outcomes measured included length of opioid therapy and average length of stay and outcomes from this group of infants in the new initiative were compared to the outcomes of the standard NICU care usually provided for infants with known opioid exposure before birth (Boucher, 2017). Results from this study showed that 15% of infants who roomed in required opioid therapy, while 83% of those who did not room-in were treated pharmacologically and those that roomed in had an average length of stay of five days versus 29 days for those that did not room in (Boucher, 2017). Even among the infants that roomed in but required some pharmacologic treatment had an average length of stay of 24 days, which is five days less than those that didn’t room in at all (Boucher, 2017).

Boucher's research also looked at the alternative intervention of acupuncture and its outcomes for managing symptoms associated with NAS. Acupuncture is more commonly used in adult populations; however, it has been proven useful to treat colic and resulting agitation in newborns (Boucher, 2017). The National Acupuncture Detoxification Association (NADA) have a treatment protocol that can be implemented as an adjunctive therapy for neonates in withdrawal (Boucher, 2017). This protocol involves needling at five points on the ear which has been effective in alleviating autonomic dysfunction symptoms associated with withdrawal by stimulating the parasympathetic nervous system, vagus nerve, cerebral cortex, and kidneys to reduce inflammation, fatigue/headache, and provide an analgesic/sedative effect (Boucher, 2017). Only three out of the five points are active reflexes in newborns, so in acupuncture therapy with the newborns, only those points are used (Boucher, 2017). One study conducted the auricular acupuncture on 76 babies and results showed that acupuncture significantly reduced the amount of pharmacologic treatment needed in comparison to the control group that did not receive acupuncture (Boucher, 2017). Another study implemented laser acupuncture, a more noninvasive procedure to optimize comfort, in addition to opioid management therapy after feedings and morphine doses (Boucher, 2017). Findings reported were that the babies feeding and caloric intake was improved, there was less of a need for pharmacologic intervention, length of stay was significantly reduced, and Finnegan scores following acupuncture therapy were decreased (Boucher, 2017).

Wu and Carre (2018) conducted a review of seven articles analyzing outcomes in breastfed versus formula fed neonates with exposure to opioids in utero. It is already known that breastfeeding improves health outcomes and can reduce a child's risk for infections, metabolic diseases, and mortality (Wu & Carre, 2018). Recommendations from the American Academy of

Pediatrics include breastfeeding exclusively for at least six months and an additional year alongside the incorporation of solid foods unless otherwise contraindicated (Wu & Carre, 2018). Breastfeeding, in fact, used to be contraindicated for mothers on opioid maintenance therapy due to the belief that harmful amounts of methadone were secreted in the breast milk, however, it has since been proven that the amount of the drug is negligible and does not exacerbate symptoms of NAS (Wu & Carre, 2018). Every hospital likely has their own policies regarding this matter but, breastfeeding is usually still encouraged if the mother is participating in a treatment program, receives regular prenatal care, refrains from using illicit drugs prior to 90 days before delivery, and proves compliant with a negative urine toxicology screening at delivery (Fragassi & Bora, 2018). Results from the articles that met inclusion criteria are as follows: Four out of seven articles measured length of hospital stay as an outcome and found that breastfed infants had shorter hospitalizations compared to formula-fed neonates by five or more days (Wu & Carre, 2018); Three out of the seven articles looked at severity of NAS as an outcome and found that the mean Finnegan score was lower in breastfed babies with an average score of 4.8 in comparison to the formula-fed infant's scores of 6.5 and ultimately required less pharmacologic intervention (Wu & Carre, 2018); Lastly, three out of the seven articles looked at the differences in length of pharmacologic intervention needed between the two types of feeding and found that there was a shorter duration of pharmacologic treatment needed in breastfed newborns by an average of 20 days (Wu & Carre, 2018).

Pharmacologic

While most NAS management recommendations prioritizes the employment of nonpharmacologic interventions, it may be medically necessary to administer an opioid to subdue the symptoms of opioid withdrawal in the neonate. Given that this indication is a

possibility, Chisamore, Labana, Blitz, and Ordean (2015) looked at methods of morphine delivery to assess which method, symptom-only or weight-based dosing, lead to a greater initiation of morphine administration. Neonates in the symptom-only dosing group were more likely to receive more morphine, however, the babies in that group who received the morphine doses did so at a similar onset as the weight-based dosing group, required nearly as much of a dose, and had similar lengths of stay (Chisamore et al., 2015). In addition, there were only five out of 57 cases where the babies in the symptom-only group never reached a dose that represented the lowest dose (0.32 mg/kg/day) in the weight-based dosing group (Chisamore et al., 2015). However, the symptom-only group had higher median peak NAS scores, which may also contribute to a potential for an increased length of stay (Chisamore et al., 2015). Recommendations included utilizing a strict weaning protocol for all opioid administration to minimize the duration of opioid treatment and consequently, length of stay (Chisamore et al., 2015).

Morphine is the most commonly used medication for pharmacologic treatment of NAS. However, recent studies suggest that other medications may be superior in improving neonatal outcomes, such as decreasing days of pharmacologic treatment and average length of stay. To start, MacMullen and Samson (2018) highlighted advantages and disadvantages of each medication that can be prescribed for treatment of NAS. Morphine has no alcohol content and a short half-life of nine hours but causes sedation, apnea, constipation, and more frequent dosing (MacMullen & Samson, 2018). Methadone has a long half-life of 26 hours and has been associated with shorter hospitalization times, but the treatment duration is longer, it has an 8% alcohol content, and frequent reassessment is necessary (MacMullen & Samson, 2018). Buprenorphine, which is not as commonly used, can be given sublingually and has a half-life of

twelve hours but has a 30% alcohol content, requires more administration of adjuvant medications, and limited research is available on the efficacy of the drug in treating NAS (MacMullen & Samson, 2018). Secondary drugs that are given include phenobarbital and clonidine. Phenobarbital has a long half-life of 45-100 hours and levels can be monitored but it has many drug-drug interactions, has a 15% alcohol content, and can cause sedation (MacMullen & Samson, 2018). Clonidine on the other hand is a non-narcotic antagonist, does not cause sedation or have any alcohol content, and has a long half-life of 44-72 hours (MacMullen & Samson, 2018). Given that it is an alpha-2 adrenergic agonist, it can cause hypotension and abruptly discontinuing it can lead to rebound hypertension and tachycardia (MacMullen & Samson, 2018).

Disher et al. (2019) conducted a meta-analysis of randomized control trials of pharmacologic treatment for NAS alone or in combination with adjuvant therapies. 18 trials were eligible for inclusion; primary outcomes analyzed were length of treatment, and secondary outcomes were length of stay, need for adjuvant therapy, and adverse events (Disher et al., 2019). Treatments that were included in the articles included buprenorphine, clonidine, diluted tincture of opium and clonidine, diluted tincture of opium, morphine, methadone, and phenobarbital (Disher et al., 2019). Results from the study showed that sublingual buprenorphine was associated with a reduced length of stay; shorter than methadone, which was shorter than morphine (Disher et al., 2019). Hypotheses for why buprenorphine was more effective included a more time-effective dosing schedule improved the safety profile due to the drug's longer half-life and increased μ-opioid receptor activity, which can prevent more reoccurrences of withdrawal symptoms associated with NAS (Disher et al., 2019). However, this was the first

article of its kind that compared the outcomes associated with different medications for treatment of NAS, so more research will need to be done to develop more credibility for these results.

Conclusion

The articles reviewed in this chapter addressed the efficacy of nonpharmacologic interventions for management of NAS and included exploration of pharmacologic interventions, knowing that it is sometimes medically indicated to administer medications. The ten articles varied from qualitative analyses to systematic reviews and included both small and large sample sizes. The literature indicated that nonpharmacologic interventions of rooming- in, acupuncture, Eat-Sleep-Console method, and breastfeeding, were all effective in reducing the severity of withdrawal symptoms, need for pharmacologic intervention, length of hospital stay, and overall cost. When pharmacologic intervention becomes necessary, the literature states that a standardized weight-based dosing with strict weaning protocol compared to symptom-only scoring ensures less dosing of opioid medications, less treatment time, and shorter hospitalizations, which is beneficial for the infants.

It would be also beneficial for future research to focus on long term developmental outcomes to see if the nonpharmacologic interventions that have been implemented have beneficial effects in that category. Because withdrawal produces physically debilitating effects, it is necessary to have the health and well-being of the child in mind, and this includes their neurodevelopment since that has a great effect on cognition and behavior which is manifested later on in life. Non-pharmacologic interventions aim to reduce the need for consumption of more opioids, since doing so seems counterintuitive for the sake of the baby's health, but if they do not prove effective in long-term outcomes, the efficacy of the interventions will be undermined. In addition, pharmacologic management is not standardized, so dosing and weaning

protocols differ nationwide. This can be problematic seeing that more babies may receive more doses of opioids and are treated for longer periods of time than what may be necessary. Further research, not only on what medication is best, but also on minimizing doses and treatment time, is necessary. Based on this review of existing literature, evidence-based best practice recommendations are needed to assist nurses and other health care professionals to effectively provide care for neonates with NAS.

CHAPTER 3

Best Practice Recommendations: Interventions for Management of NAS

The purpose of this thesis was to create informed best practice recommendations to manage the symptoms associated with NAS using the least invasive means. As shown in Table 1, this chapter details the proposed best practice recommendations to help nurses and other health care professionals develop a care plan that help neonates ease through withdrawal using non-pharmacologic interventions.

The literature reviewed in the previous chapter detailed important findings regarding the efficacy of non-pharmacologic interventions and pharmacologic interventions pertaining to management of symptoms of NAS. As the research has shown, interventions such as rooming-in, breastfeeding, acupuncture, and the Eat-Sleep-Console method, were effective in reducing the severity of NAS symptoms and contributed to a decrease in the need for pharmacologic intervention, length of hospitalization in the NICU, and overall cost. In addition, the criteria in which medications are determined to be administered to treat NAS symptoms has been specified to ensure the lowest possible dose of the most effective opioids that is necessary.

Table 1

Best Practice Recommendations for Management of Neonatal Abstinence Syndrome

Recommendation	Rationale	References	Level of Evidence
Rooming-In	• Promoting the bonding of the maternal-dyad relationship by increasing parental	Sanlorenzo, L. A., Stark, A. R., & Patrick, S. W. (2018). Neonatal abstinence syndrome: An update. *Current Opinion in Pediatrics, 30*(2), 185. doi:	Level I

	presence at the bedside reduces the number of opioid treatment days and length of stay.	10.1097/MOP.0000000000000589 [doi] Grossman, M.R., Berkwitt, A.K., Osborn, R.R., Xu, Y., Esserman, D.A., Shapiro, E.D., Bizzarro, M.J. (2017). An initiative to improve the quality of care of infants with neonatal abstinence syndrome. *Pediatrics, 139*(6). doi: 10.1542/peds.2016-3360 [doi] Boucher, A. M. (2017). Nonopioid management of neonatal abstinence syndrome. *Advances in Neonatal Care : Official Journal of the National Association of Neonatal Nurses, 17*(2), 84-90. doi:10.1097/ANC.0000000000000371 [doi]	Level III Level I
Breastfeeding	• The concentration of opiates in infants breastfed by mothers on OMT is negligible and that there were no neurological symptoms from the exposure of opiates through breast milk. • Breastfeeding strengthens the mother-infant dyad and contributes to the reduction of NAS duration and severity.	Grossman, M.R., Berkwitt, A.K., Osborn, R.R., Xu, Y., Esserman, D.A., Shapiro, E.D., Bizzarro, M.J. (2017). An initiative to improve the quality of care of infants with neonatal abstinence syndrome. *Pediatrics, 139*(6). doi: 10.1542/peds.2016-3360 [doi] Wu, D., & Carre, C. (2018). The impact of breastfeeding on health outcomes for infants diagnosed with neonatal abstinence syndrome: A review. *Cureus, 10*(7), e3061. doi:10.7759/cureus.3061 [doi] Fragazzi, P. A. & Bora, G. (2018). Creating a community of support for children and families affected by opioid dependence: Identifying and addressing gaps in maternal-fetal care. *ZERO TO THREE Journal, 38* (5), 29-38.	Level III Level I Level VII

Low Stimulation Environment	• Dimming lights and reducing noise can minimize agitation of the newborn and decrease NAS scores.	Grossman, M.R., Berkwitt, A.K., Osborn, R.R., Xu, Y., Esserman, D.A., Shapiro, E.D., Bizzarro, M.J. (2017). An initiative to improve the quality of care of infants with neonatal abstinence syndrome. *Pediatrics, 139*(6). doi: 10.1542/peds.2016-3360 [doi]	Level III
Eat-Sleep-Console Method (ESC)	• ESC method of assessing need for pharmacologic intervention eliminates the inaccuracies of the Finnegan scoring method. • If an infant can breastfeed effectively or take ≥ 1 oz from a bottle per feed, to sleep undisturbed for ≥1 hour, and, if crying, to be consoled within 10 minutes, then morphine is neither started nor increased regardless of other signs of withdrawal. • Treatment of NAS using the ESC method lead to significantly less frequent morphine treatments than if using Finnegan scoring.	Grossman, M.R., Berkwitt, A.K., Osborn, R.R., Xu, Y., Esserman, D.A., Shapiro, E.D., Bizzarro, M.J. (2017). An initiative to improve the quality of care of infants with neonatal abstinence syndrome. *Pediatrics, 139*(6). doi: 10.1542/peds.2016-3360 [doi] Grossman, M. R., Lipshaw, M. J., Osborn, R. R., & Berkwitt, A. K. (2018). A novel approach to assessing infants with neonatal abstinence syndrome. *Hospital Pediatrics*, 8(1), 1-6. doi:10.1542/hpeds.2017-0128 [doi] Wachman, E. M., Grossman, M., Schiff, D. M., Philipp, B. L., Minear, S., Hutton, E., . . . Whalen, B. L. (2018). Quality improvement initiative to improve inpatient outcomes for neonatal abstinence syndrome. *Journal of Perinatology: Official Journal of the California Perinatal Association, 38*(8), 1114-1122. doi:10.1038/s41372-018-0109-8 [doi]	Level III Level III Level IV
Acupuncture	• Acupuncture at 3 auricular points can	Boucher, A. M. (2017). Nonopioid management of neonatal abstinence	

	reduce autonomic dysfunction associated with NAS.	syndrome. *Advances in Neonatal Care : Official Journal of the National Association of Neonatal Nurses, 17*(2), 84-90. doi:10.1097/ANC.0000000000000371 [doi]	Level I
Buprenorphine Treatment for Pharmacologic Management	• Sublingual buprenorphine is considered the optimal treatment for a reduction in length of pharmacologic treatment and length of stay; however, it did require more adjuvant therapies.	Disher, T., Gullickson, C., Singh, B., Cameron, C., Boulos, L., Beaubien, L., & Campbell-Yeo, M. (2019). Pharmacological treatments for neonatal abstinence syndrome: A systematic review and network meta-analysis. *JAMA Pediatrics*. doi:10.1001/jamapediatrics.2018.5044 [doi]	Level I
Weight-Based Dosing of Morphine with Strict Weaning Protocol	• If receiving morphine, the weight-based dosing method can lead to less doses of morphine and shorter length of stay. • Morphine can be weaned by 10% three times per day with the use of non-pharmacologic therapies.	Chisamore, B., Labana, S., Blitz, S., & Ordean, A. (2016). A comparison of morphine delivery in neonatal opioid withdrawal. *Substance Abuse: Research and Treatment, 10*(1), 49-54. doi:10.4137/SART.S34550 [doi] Grossman, M.R., Berkwitt, A.K., Osborn, R.R., Xu, Y., Esserman, D.A., Shapiro, E.D., Bizzarro, M.J. (2017). An initiative to improve the quality of care of infants with neonatal abstinence syndrome. *Pediatrics, 139*(6). doi: 10.1542/peds.2016-3360 [doi]	Level IV Level III

Summary of Best Practice Recommendations

Given that the opioid crisis is a multi-dimensional public health problem, managing NAS should begin at primordial prevention efforts to address social determinants of health. However, the literature reviewed in the previous chapter summarized significant findings regarding interventions to better manage NAS while in the hospital, so as to promote the best care possible for the infant. There are many modalities that can contribute to favorable outcomes, such as minimizing the need for pharmacologic interventions, shorter treatment periods, shorter length of stay, and lower NAS scores. Evidence showed that parents rooming-in with the infant during the hospital stay facilitates the maternal-newborn relationship and significantly reduces NAS scores and the need for administering an opioid to manage withdrawal symptoms. In addition, a low stimulation environment, characterized by reduced noise and low lighting can minimize the symptoms associated with NAS. Breastfeeding the newborn, according to facility policies, is recommended since the amount of opioid transferred through breast milk is negligible and can further bonding between the mother and infant, which has shown to reduce NAS scores and the need for pharmacologic management. Acupuncture at three points on the outer ear has also been shown to reduce the severity of the autonomic symptoms of NAS, which also contributes to minimizing unnecessary pharmacologic treatments since it lowers NAS scores. The most recent innovation in NAS management is the implementation of the Eat-Sleep-Console method to determine the severity in which NAS is affecting the infant in place of the Finnegan scoring tool. By using this more conservative scoring method, administration of opioids is reduced, and therefore, length of treatment and hospitalization is decreased. However, there are still cases where infants do show signs that deem pharmacologic treatment necessary, and the most effective treatments should be chosen. Sublingual buprenorphine has been shown to be the

optimal treatment for NAS as opposed to morphine, however if morphine is chosen, weight-based dosing and a strict weaning protocol should be implemented.

CHAPTER 4

Implementation and Evaluation

The initial section of this chapter will focus on implementing the creation of a sub-unit on a mother-baby unit within a hospital that is aimed to serve mothers and their babies who are suffering from prenatal drug exposure. The staff on this wing will employ and teach about the evidence-based practice recommendations regarding management of NAS in order to support the families during their postpartum hospitalization and adjustment to caring for their baby. Based on the recommendations from the previous chapter, nurses, nurse educators, and lactation consultants will be assigned as frontline leaders who are in charge of implementing the interventions. In addition, they are responsible for educating the family on these interventions in order to allow the family to build their confidence and have an integral role in caring for their newborn. Before discharge, case management should ensure that the family is given resources regarding applicable community support groups and that continued care for the mother is pre-arranged.

In order to implement this sub-unit, the Plan-Do-Study-Act (PDSA) Cycle will be used. The PDSA Cycle will serve as a framework for the implementation of the sub-unit into the Mother-Baby unit of a hospital as a quality improvement project (Institute for Healthcare Improvement, 2017). The PDSA cycle is a commonly used method that guides the implementation of evidence-based research into the clinical practice setting (Institute for Healthcare Improvement, 2017). The important aspects of the PDSA cycle that will be addressed in the implementation process of this thesis are Plan, Do, Study, and Act (Institute for Healthcare Improvement, 2017).

In the latter section of this chapter, the evaluation of implementing the sub-unit will be addressed. While utilizing the PDSA cycle, testing the sub-unit will begin on a small scale, such as in one hospital, learning from each PDSA cycle. After refining the sub-unit through several PDSA cycles, the change may be implemented on a broader scale, such as among other hospitals within the health system that contain a maternal newborn unit. The study stage of the PDSA cycle will be utilized to detail the evaluation process of the sub-unit, and the act stage of the cycle will allow for refinements to be made based on what was learned from the previous plan, do, and study stages. Finally, the strengths and limitations of the sub-unit and additional recommendations for future research related to NAS management will be discussed.

Implementation

Implementing Family Centered Care on a Mother-Baby Sub-Unit

Research has indicated that to improve the quality of care of newborns with NAS, care should be provided outside of the neonatal intensive care unit (NICU). Utilizing a sub-unit within a mother-baby floor is one approach that can be implemented to deliver evidence-based best practices to this particular demographic provided that the babies are medically stable. The sub-unit will be theoretically implemented using the PDSA cycle on the maternity unit of a local hospital. Through further cycles of PDSA, the sub-unit can then be implemented among other hospitals within the healthcare system.

Plan. Plan is the first stage of the PDSA cycle that will direct the implementation of a NAS subunit into a hospital's maternity unit. The planning stage begins with brainstorming ideas regarding multiple factors of the sub-unit such as staffing, training, and stakeholders.

The NAS sub-unit will have four rooms available for babies with NAS, which can also accommodate the mothers. According to the Association of Women's Health, Obstetric &

Neonatal Nursing's (AWHONN) most recent perinatal staffing recommendations, no more than six women without postpartum complications, three women with complications, or two women recovering from caesarian section can be cared for by one nurse (AWHONN, 2011). No more than three newborns requiring intermediate care can be cared for by one nurse (AWHONN, 2011). Therefore, the ideal nurse-patient ratio for this specialized couplet care unit will be one nurse to two couplets. It is expected that when all the beds are occupied, two nurses will staff the sub-unit in addition to one patient care technician which can have more beds assigned beyond the subunit.

While the unit will be staffed with preferably experienced maternal-newborn nurses, it will be necessary to train them to take care of this specific population. The training will include teaching them about evidenced-based practice recommendations for caring for a newborn with NAS and their family. The nurse's main focus is to ensure the health and wellbeing of the mother. They will also be responsible for facilitating the care of the newborn by educating the family on these best-practice care strategies to practice while in the hospital so that they family is confident in their ability to care for the child after discharge. While it is the goal to keep the baby with the mother, if at any time a nurse's assessment indicates the need for further medical care than what can be provided in the unit, it is necessary to consult with the healthcare provider and organize a transfer to the NICU to ensure optimum health and safety of the newborn.

Stating a clear objective for the implementation of the sub-unit is another dimension of the planning stage in the initial PDSA cycle (Institute for Healthcare Improvement, 2017). While, the nurse is responsible for primary bedside care of the newborn and mother, there are many other stakeholders that need to be on board with the implementation of this sub-unit. The nurse managers and director of the maternal-newborn unit must be the primary advocates for the

implementation of the care provided on the sub-unit. In the planning stage, they are responsible for exposing the unit staff to the aim of the evidence-based practice recommendations and ensure understanding of the overall purpose and objective after getting approval from the hospital administration (Institute for Healthcare Improvement, 2017). From there, they can coordinate with the neonatologists or neonatal nurse practitioners, who establish the orders for the care of the newborn. Because of this, those health care providers should be made aware of the evidenced-based practice recommendations in order for there to be a continuity of care and promote the best possible outcomes. In addition, they should be mindful about pharmacologic interventions such as what medications, if needed, have been associated with improved outcomes.

The last element of the plan stage in the PDSA cycle is to develop a plan to test the effects of the sub-unit (Institute for Healthcare Improvement, 2017). In order to evaluate the effects of the PDSA cycle, the newborn's length of stay, length of treatment, and cost of hospitalization will be monitored and recorded. In addition, a pre- and post- survey can be given to the mothers and the respective nurses in order to assess and detect changes in the confidence in the mother's ability to successfully care for the newborn. Lastly, focus groups of staff can be held in order to obtain their feedback regarding the sub-unit so that strengths and stressors can be identified.

Do**.** The Do stage of the PDSA cycle indicates that the implementation should be tried out on a small scale (Institute for Healthcare Improvement, 2017). The theoretical implementation of the sub-unit will address the various evidence-based practice recommendations for the care of newborns with NAS. The nursing staff will be trained so that they learn about the recommendations in order to put them into practice. Family-centered care of

the newborn, which is strengthened by rooming-in, breastfeeding, and a low stimulation environment will be prioritized. In addition, the ESC method will be implemented for every baby before considering the administration of medications to aid with withdrawal symptoms. Aside from those recommendations, there are some techniques that can be implemented to aid in any gastrointestinal discomfort or general irritability. Examples of these include swaddling the baby with their limbs flexed, vertical rocking, shushing, swaying, side-lying, sucking, feeding, tummy time, and massage. Any mother and their newborn will be offered to be assigned to a room on the sub-unit so long as drug use is disclosed, and social services has deemed it safe to keep the maternal-infant dyad together. During this stage of implementation, unit staff behavior and reception of the sub-unit will be observed; it is also during this stage that problems and unexpected observations would be documented (Institute for Healthcare Improvement, 2017). The newborn's length of stay, length of pharmacologic treatment, and cost of hospitalization will be monitored and recorded for every dyad. In addition, a pre- and post- survey can be given to the mothers and the nurse in order to assess and detect changes in the confidence in the mother's ability to successfully care for the newborn. The last element of the Do stage would include a focus group held by the unit managers and director to assess staff and provider feedback regarding the sub-unit and its utility.

Summary

The implementation process for best practice recommendations to improve the care of infants who have NAS was developed from research on the effectiveness of a mother-baby subunit for babies with NAS and the PDSA cycle for improvement. Utilizing a sub-unit that is geared toward supporting mothers to care for their newborn in the face of adversity ensures that the content associated with best-practice for the care of babies with NAS is received in an

effective manner to the intended audience, in this particular case, the nursing staff so that they are capable of teaching the mothers. Furthermore, the PDSA cycle for improvement is a model that takes the scientific method and applies it to a health care environment using action-oriented learning (Institute for Healthcare Improvement, 2017). The initial steps covered in this section include Plan and Do (Institute for Healthcare Improvement, 2017). In the next section, the PDSA's Study and Act stages will be discussed along with the evaluation of implementing the sub-unit.

Evaluation

The Study and Act stages of the PDSA cycle, as well as the evaluation of implementing the subunit, are the last portions that will be discussed with respect to the integration of the best-practice recommendations for caring for babies with NAS into practice. The Study stage of the PDSA cycle allows for evaluation to determine whether or not the sub-unit was an effective intervention (Institute for Healthcare Improvement, 2017). The Act Stage allows for making necessary changes to the sub-unit based on what was learned from the previous cycle stages (Institute for Healthcare Improvement, 2017).

Evaluating Family Centered Care on a Mother-Baby Sub-Unit

Study. During the Study stage, the unit managers and director of the mother-baby unit would evaluate the efficacy of implementing the sub-unit within their unit (Institute for Healthcare Improvement, 2017). They will be responsible for evaluating the following outcomes: the length of stay, the length of pharmacologic treatment, and the cost. In addition to the outcomes, they will evaluate the results of the pre - and post- survey to assess and detect changes in the confidence of the nurses to successfully support and teach these mothers about how best to

care for the newborn that is withdrawing and, in turn, understand how confident the mothers feel. Lastly, feedback obtained from the staff focus groups will be analyzed.

Another component of the Study stage of the PDSA cycle is to compare the collected data with predictions (Institute for Healthcare Improvement, 2017). The intended outcome associated with implementing the best practice recommendations on the sub-unit would align with the prediction that length of pharmacologic treatment, length of stay, and cost would all decrease while the nurses' and mothers' confidence increased (Institute for Healthcare Improvement, 2017). Unit staff would be expected to report that the sub-unit allowed them to care for both the mother and baby to the best of their abilities. The last factor of the Study stage is to summarize and reflect upon what was learned through the implementation of the sub-unit (Institute for Healthcare Improvement, 2017).

Act. The final stage of the PDSA cycle is the Act stage (Institute for Healthcare Improvement, 2017). During the Act stage, changes to the sub-unit can be made based on what was learned from the previous cycle stages (Institute for Healthcare Improvement, 2017). Items to consider may include changes to staffing, such as increasing or decreasing the nurse-patient ratio, or changes to the training on how to implement the best practice recommendations and teach the mothers. In this final stage of the PDSA cycle, a plan for the next PDSA cycle test will be made based on the results and refinements of this cycle (Institute for Healthcare Improvement, 2017).

Strengths and Limitations of Thesis

The primary strength of this best practice recommendation thesis is that it included a thorough review of literature that resulted in a collection of evidence-based interventions that will allow for better care of newborns with NAS. This thesis incorporates a majority of the most current research related to the management of NAS and proposes an attempt to integrate the recommendations into the care of newborns in an ideal setting. By creating a sub-unit on a maternal-newborn floor, many of the resources provided in a hospital can be easily accessible such as lactation consultants, physical therapy, speech therapy, neonatologists, case management, and social services – all of which are necessary services that a newborn needs.

One limitation of this thesis is that the sub-unit only caters to the mother-infant dyads that remain together. It is known that the Department of Child Services is involved with every case of prenatal drug exposure and there is a chance that their evaluations lead to separating the child from the biological mother. In those cases, the infant will have to be cared for elsewhere. In addition, if a newborn's status were to indicate a need for more extensive medical care, the sub-unit would not be conducive for providing that level of care.

Summary

The purpose of this thesis was to develop best practice recommendations to better provide care of newborn babies that has NAS. Current research indicates that the Finnegan Scoring Tool might not be the most effective modality for indicating the extent of withdrawal that a baby is in. It leads to a greater number of doses of morphine being administered, which seems counterintuitive for treating a baby who is dependent on the same class of drugs: opioids. Alternatively, the employment of a combination of interventions can allow for successful non-pharmacologic management of NAS. The literature confirms the efficacy of breastfeeding, rooming-in, a low stimulation environment, the Eat-Sleep-Console method, and acupuncture for the management of symptoms associated with NAS. In an attempt to create an environment suitable to employ all of the recommendations for best practice, the idea of a sub-unit on a mother-baby unit was created. The evaluation process of the project, seen in the Study and Act stages of the cycle, would allow for certain outcomes to be measured such as length of stay, length of pharmacologic treatment, and cost. In addition, nursing staff and mothers can provide feedback about the education they provided and received and whether or not it had any influence on their perceived ability to provide the necessary support for these women and confidence to take care of the newborn. Overall, implementation of the sub-unit will allow nurses to care for and educate families on how to care for their newborn according to best practice recommendations in the most ideal place in an effort to produce the best possible outcomes for the infant and the family unit.

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